

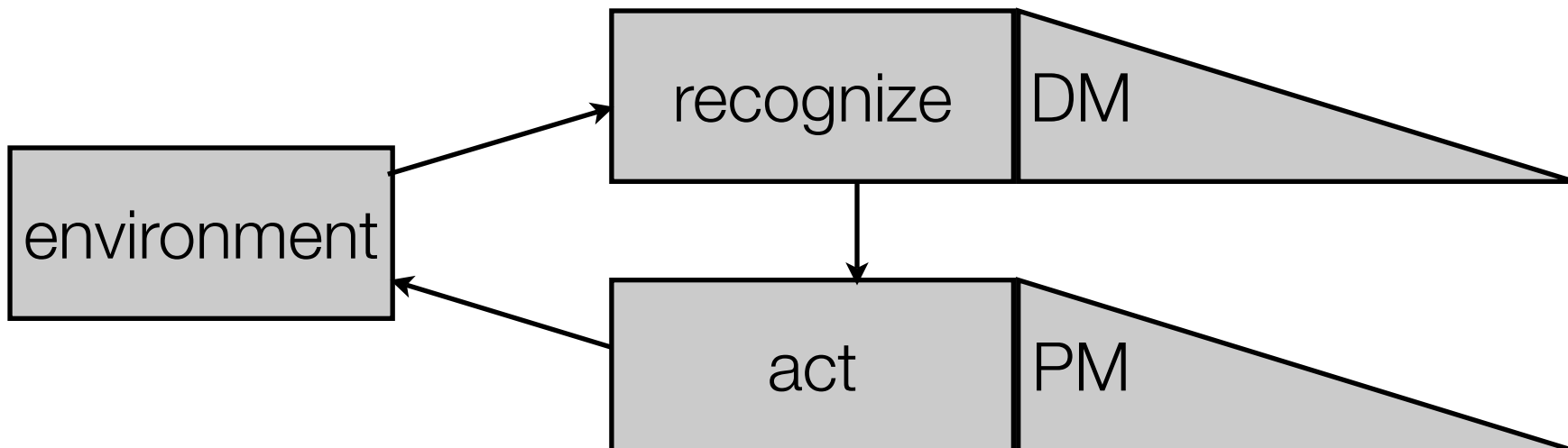
Special Topics in Memory

Review

- What does it mean to store something in long-term memory?
- What does it mean to have something in short-term memory?
- What is Hebbian learning?

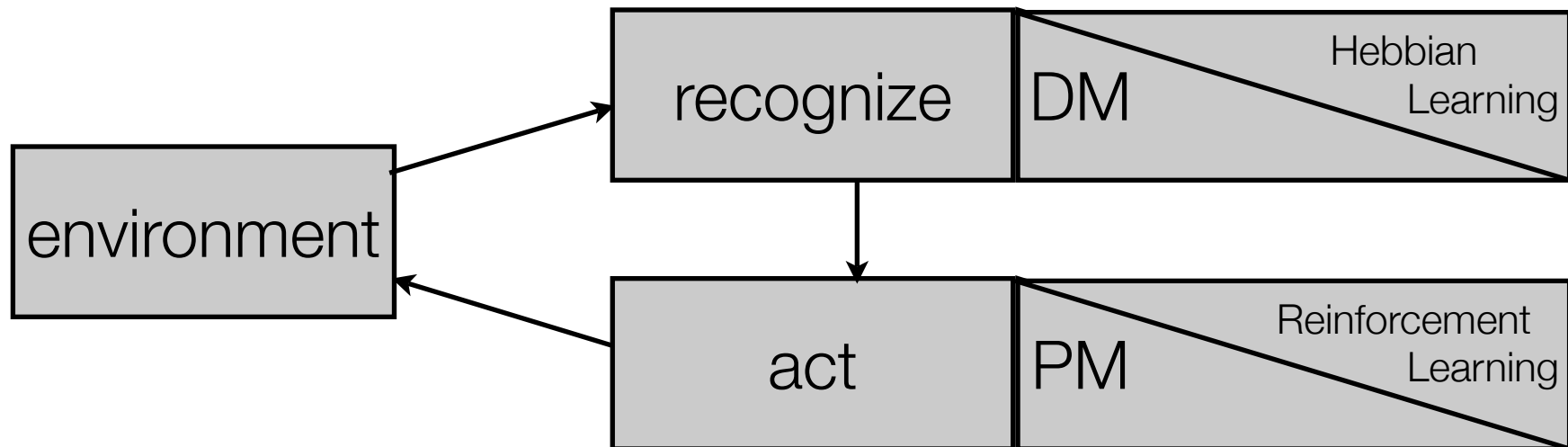
Putting it all together...

- Declarative vs Procedural memory
 - So far we have been concentrating on declarative memory
 - We will concentrate on procedural in the last couple of lectures
- Recognize-Act Cycle



Putting it all together...

- Recording memories (learning) vs using memories (recognition/action)

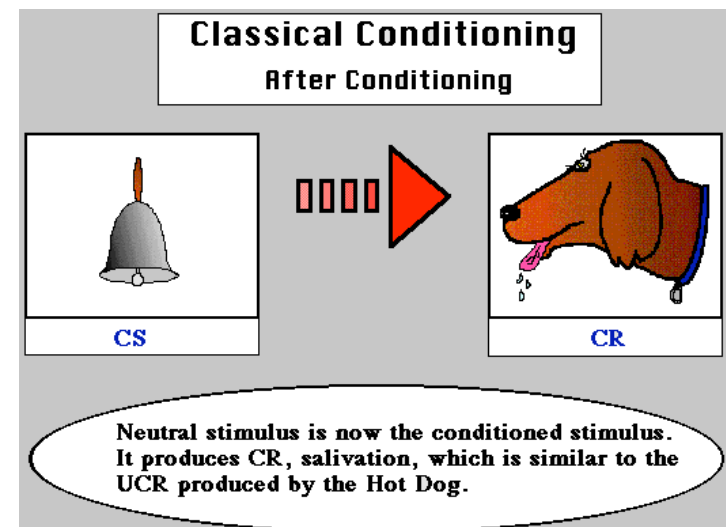
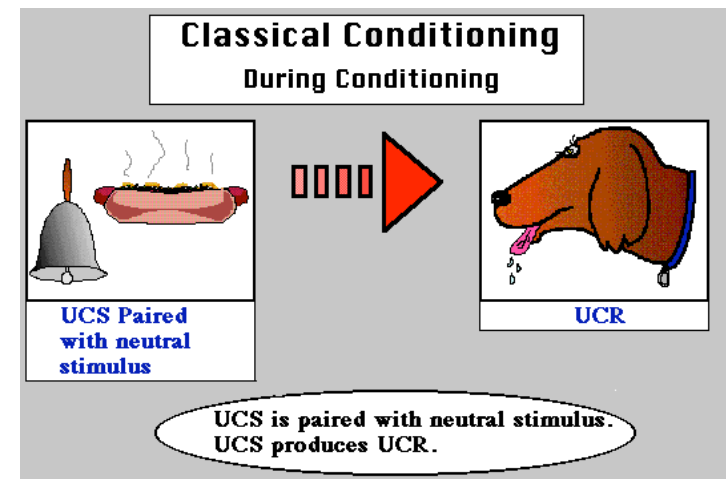
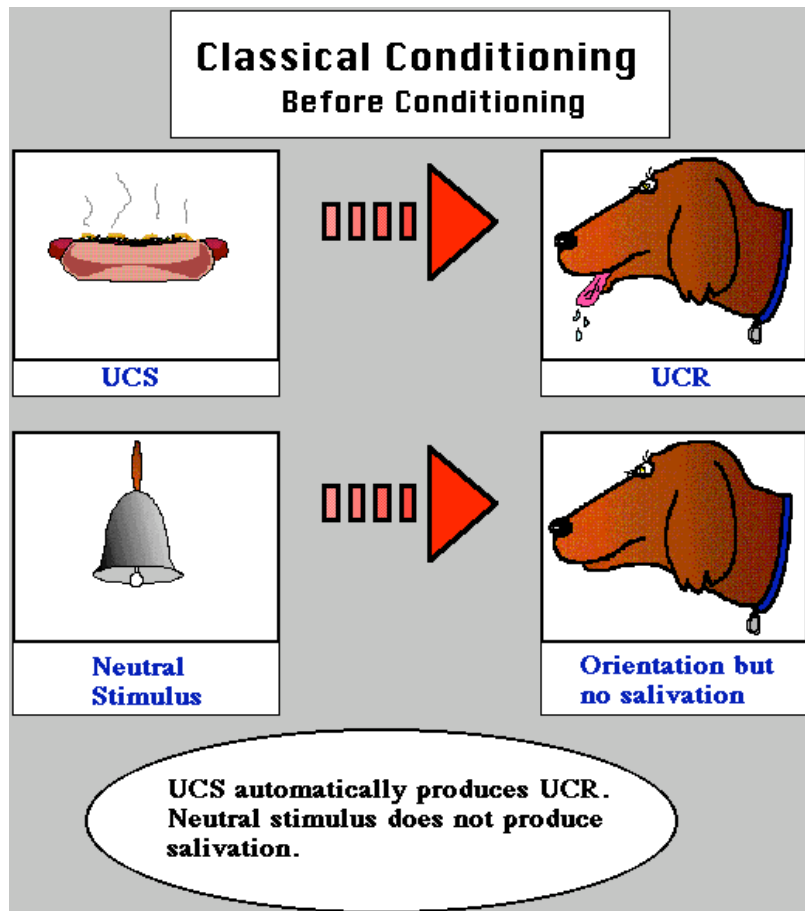


* this is not to say that there is no RL in DM or HL in PM

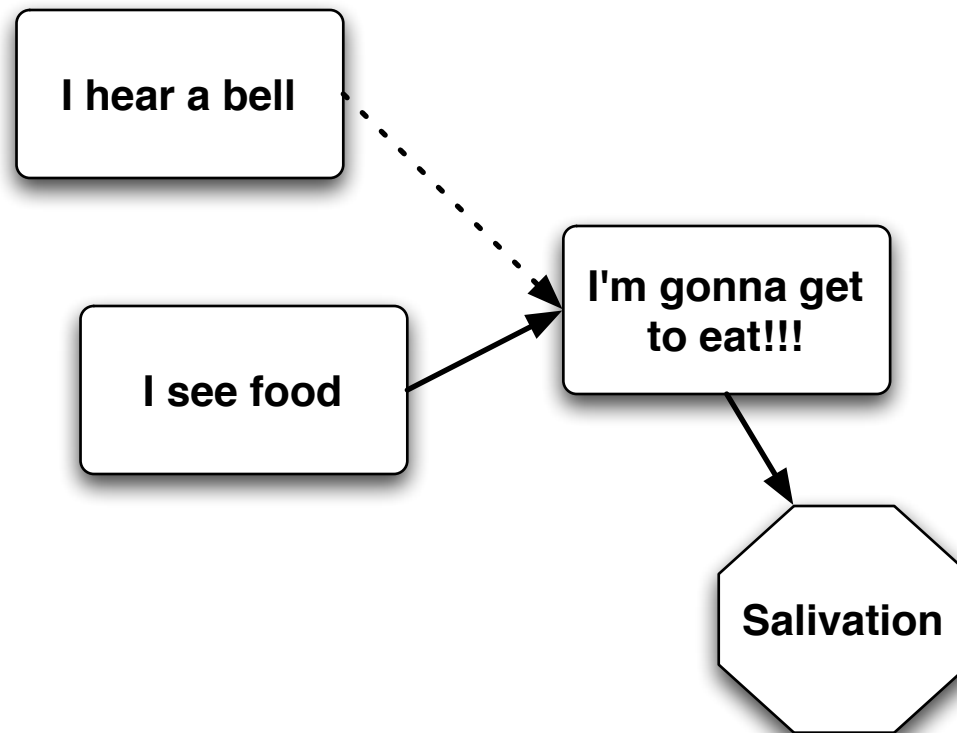
Declarative Memory: Learning and Recognition

- Recognition
 - **spreading activation**
 - neurons fire; excite/inhibit other neurons
- Learning
 - **Hebbian learning**
 - neurons that fire together, wire together

Classical Conditioning



Hebbian representation of classical conditioning



Categorization

- “To Cognize is to Categorize: Cognition is Categorization... All of our categories are just ways we behave differently toward different kinds of things... and isn't that what cognition is all about – and for?” – Harnad, 2003
- “One of the most basic functions of all organisms is the cutting up of the environment into classifications by which nonidentical stimuli can be treated as equivalent.” - Rosch, Mervis, Gray, Johnson, & Boyes-Braem (1976)
- Wickelgren (1981); Shepard (1987); Nosofsky (1992); etc, etc, etc...

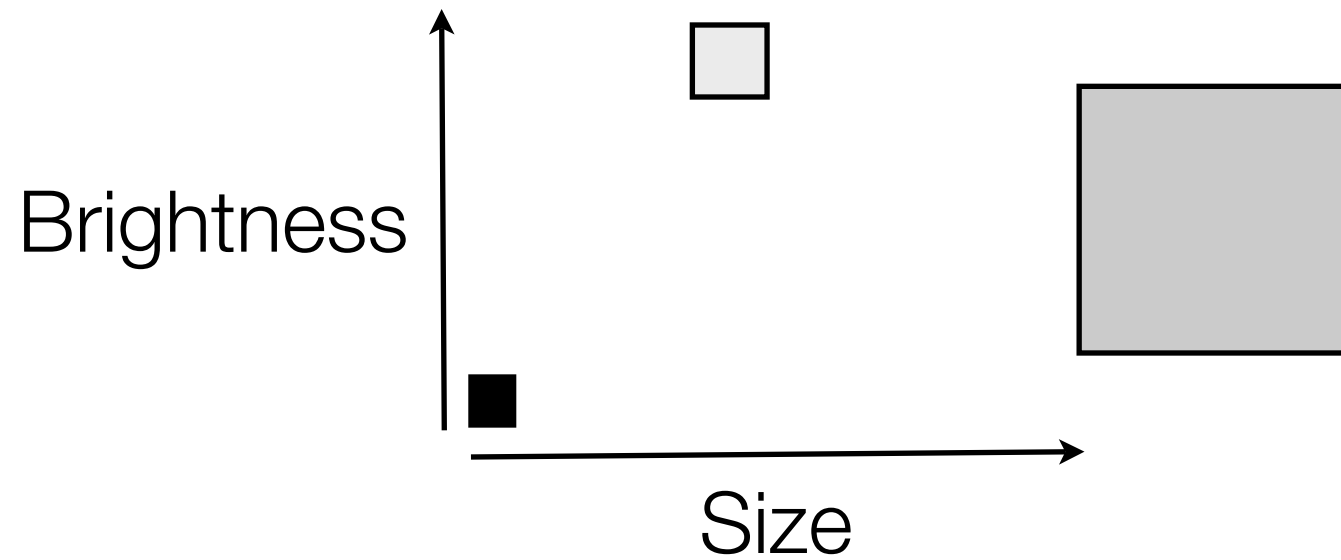
Categorization

- Category learning / Category recognition
- Necessity for invariant representations

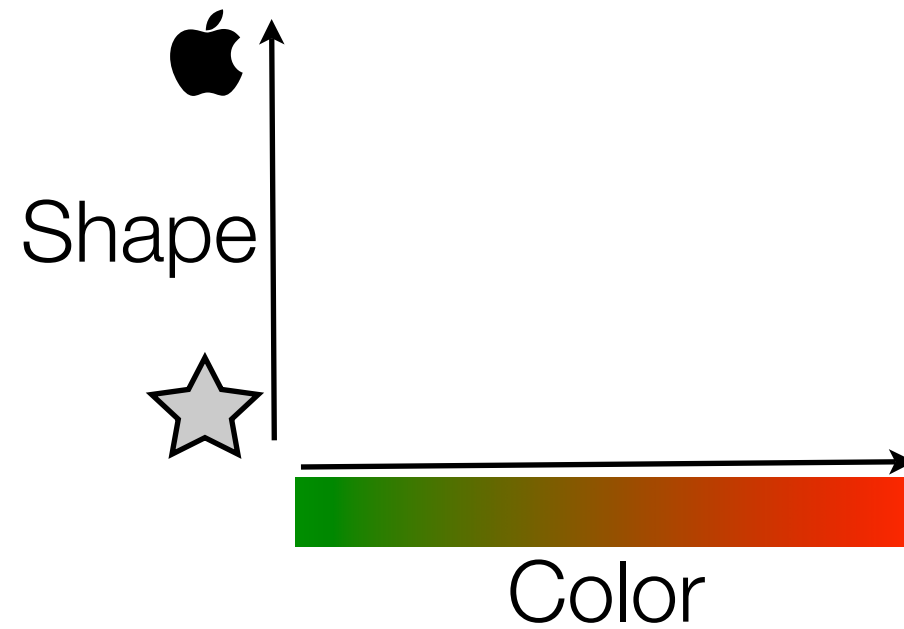
- Category representation
 - Rules (definitional approach)
 - Prototypes
 - Exemplars

Multi-dimensional Semantic Space

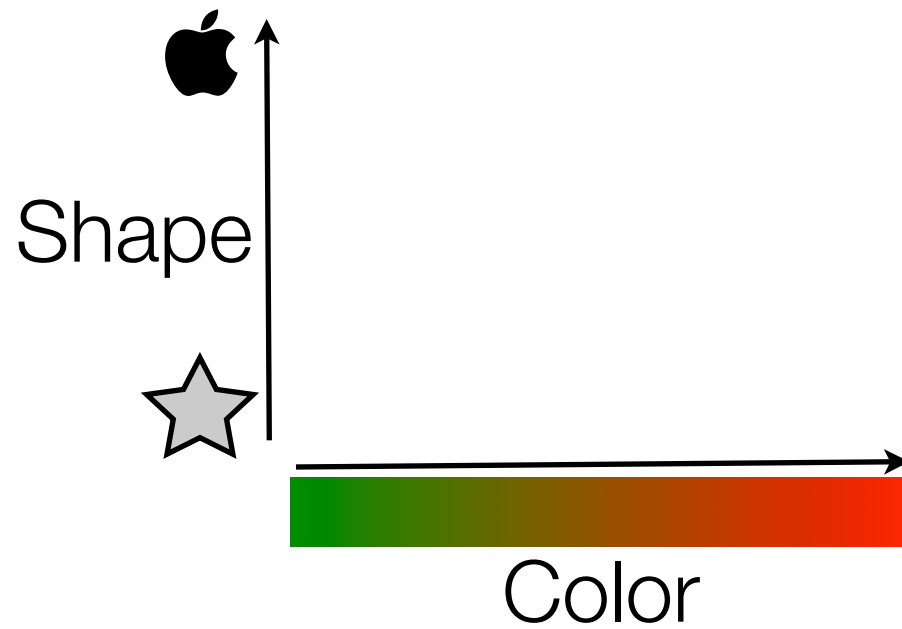
- How do you know two things are alike?



Multi-dimensional Semantic Space



Multi-dimensional Semantic Space



Multi-dimensional Semantic Space



Shape



Color

Multi-dimensional Semantic Space



Shape



Color

Multi-dimensional Semantic Space

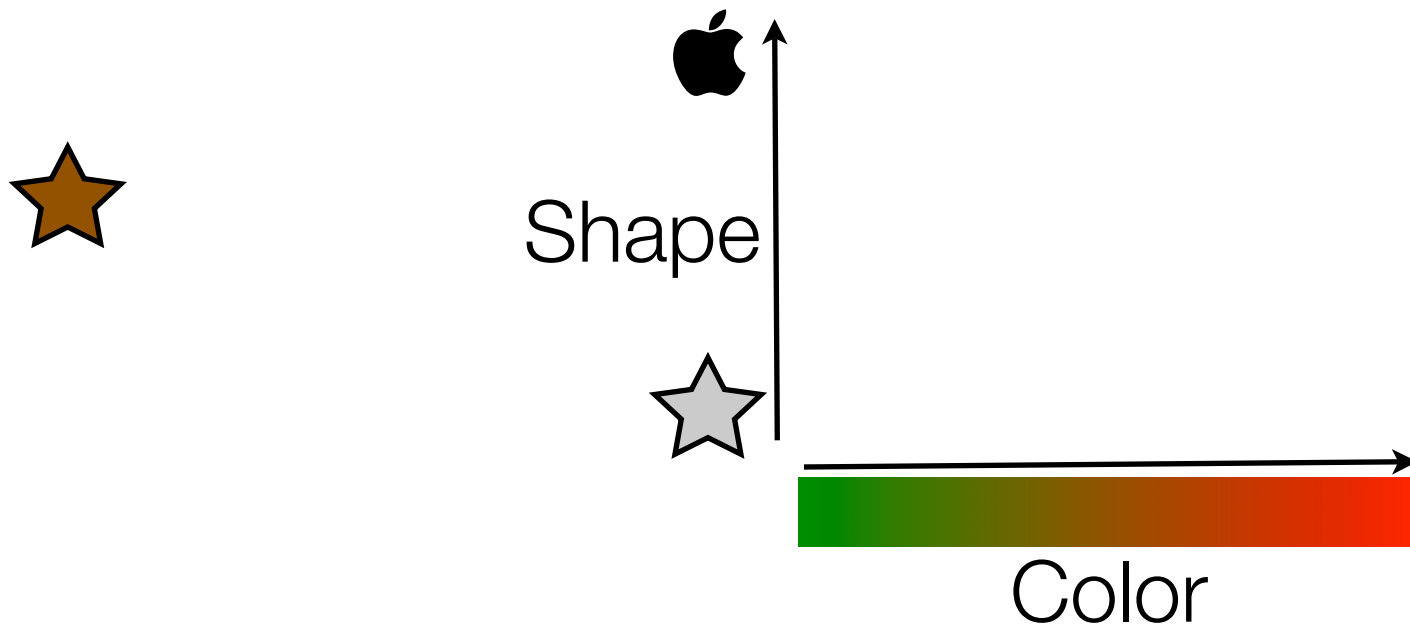


Shape

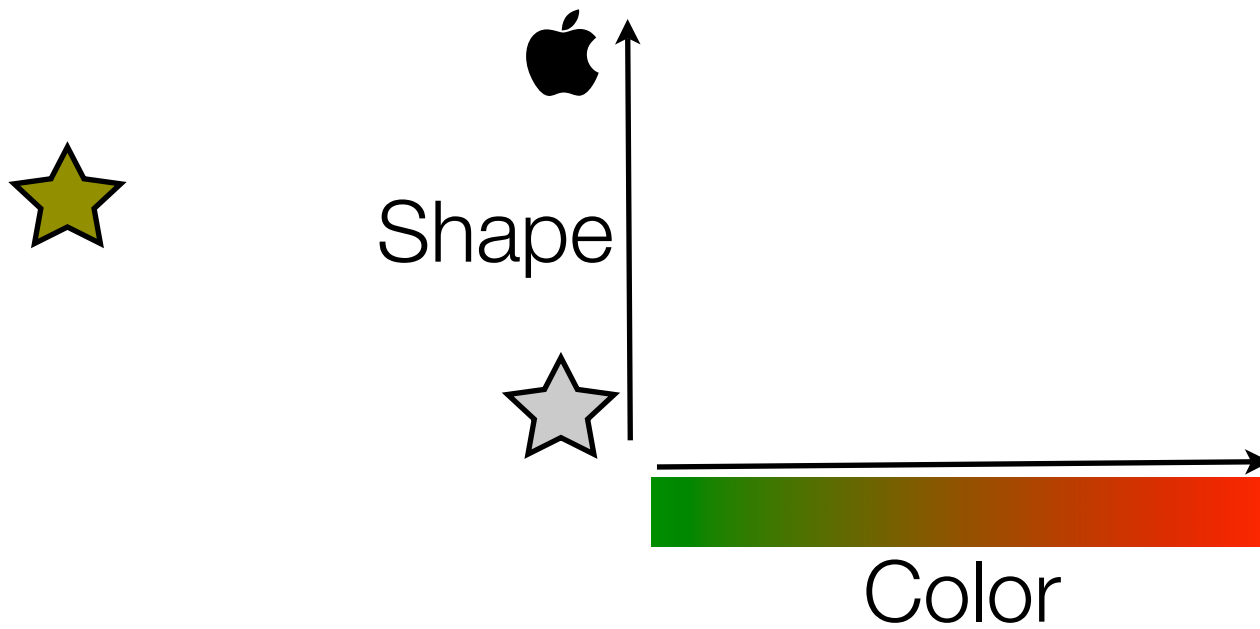


Color

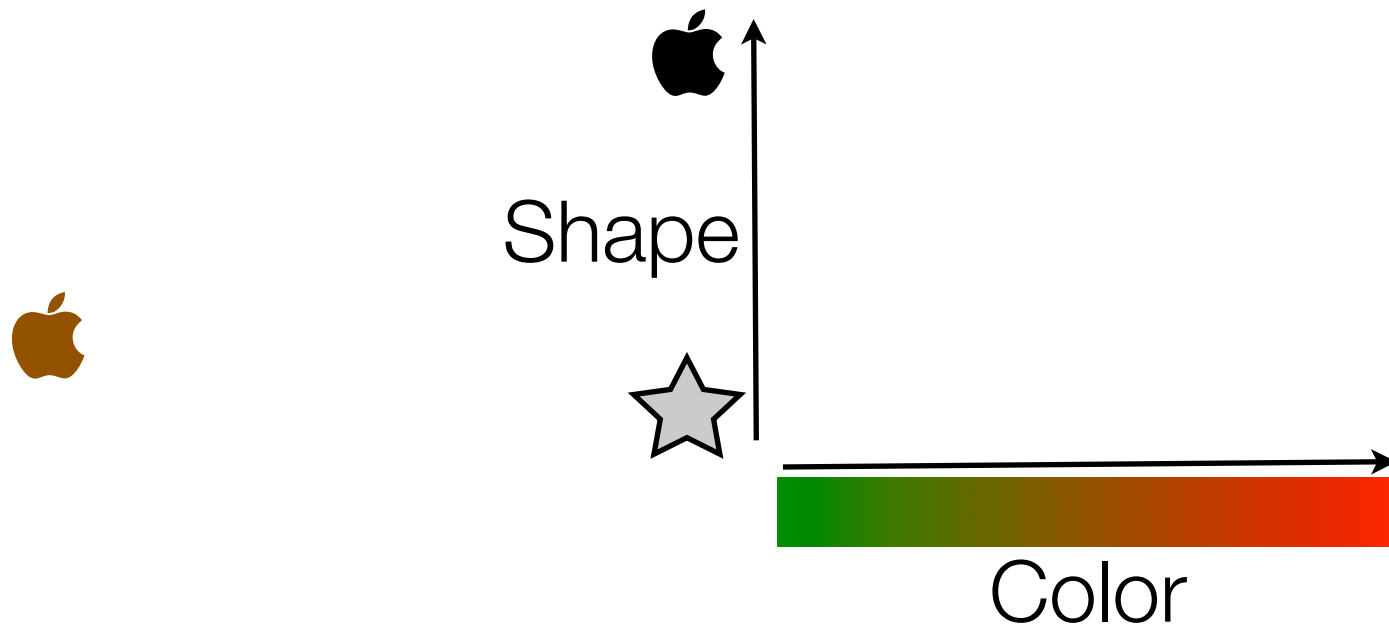
Multi-dimensional Semantic Space



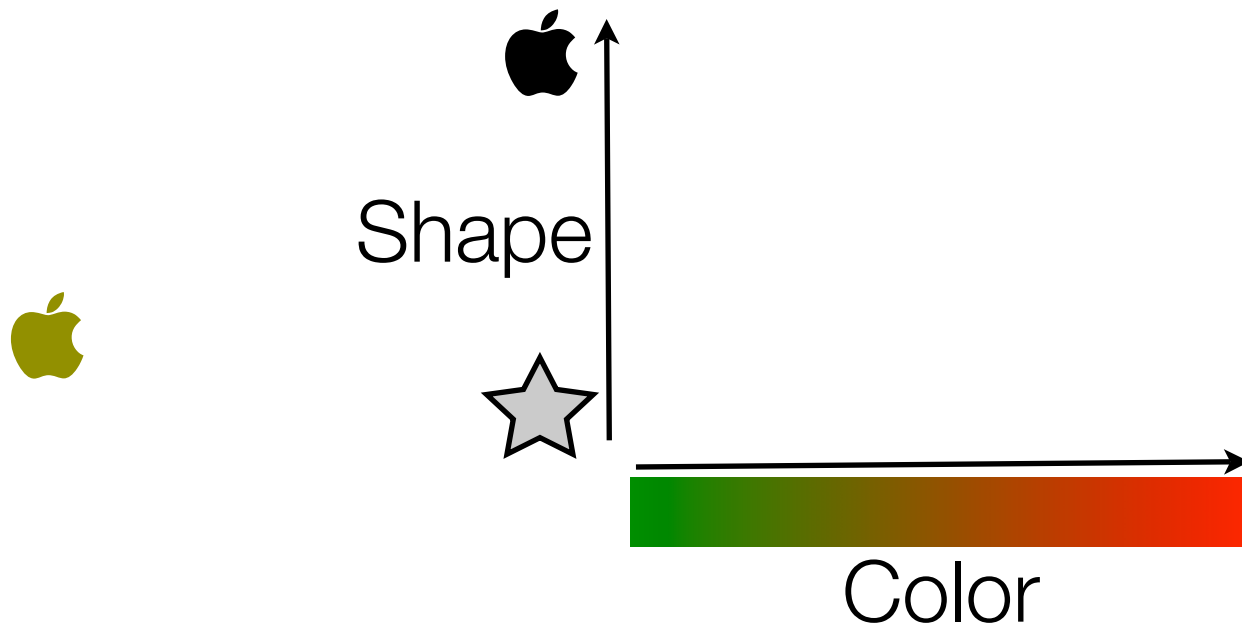
Multi-dimensional Semantic Space



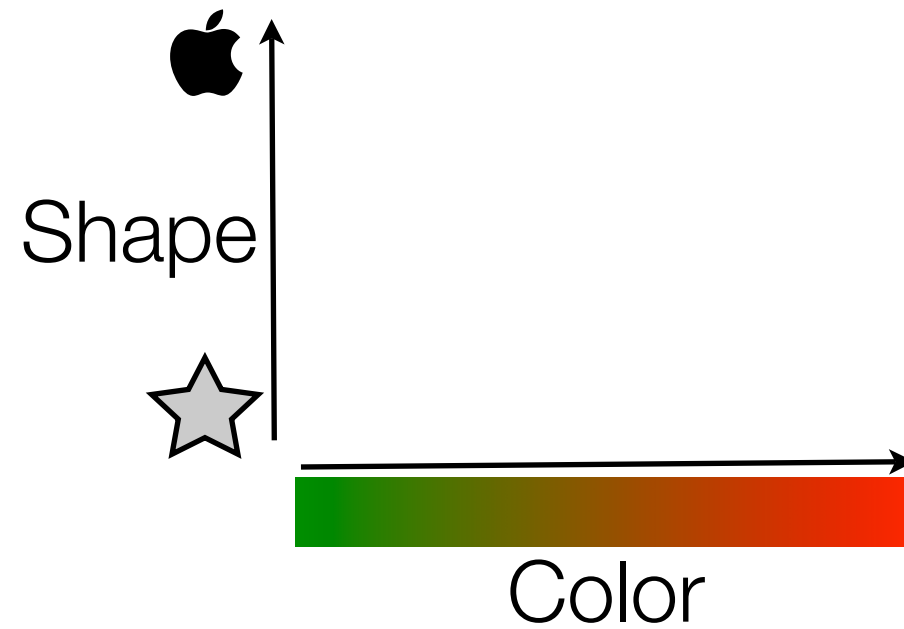
Multi-dimensional Semantic Space



Multi-dimensional Semantic Space

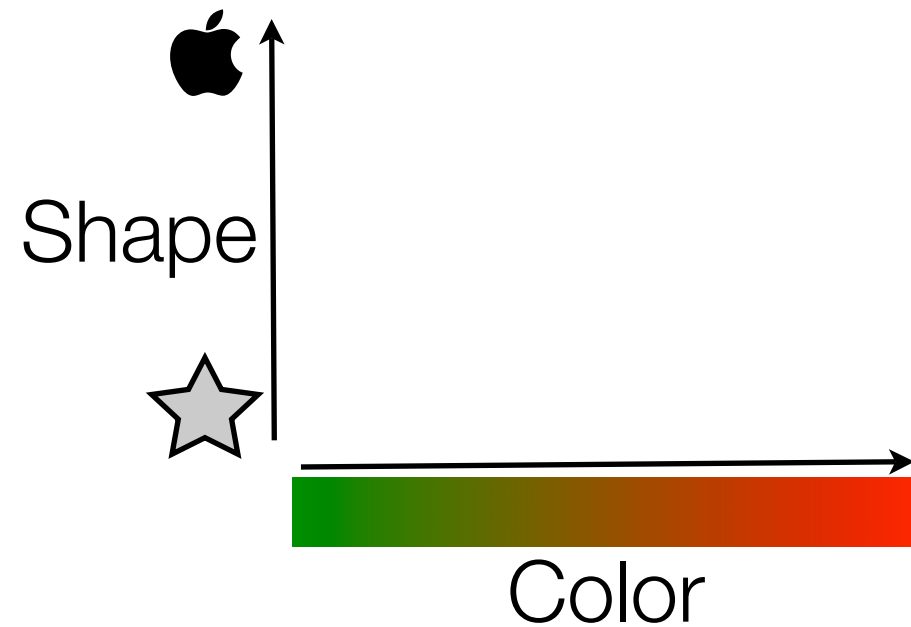


Multi-dimensional Semantic Space



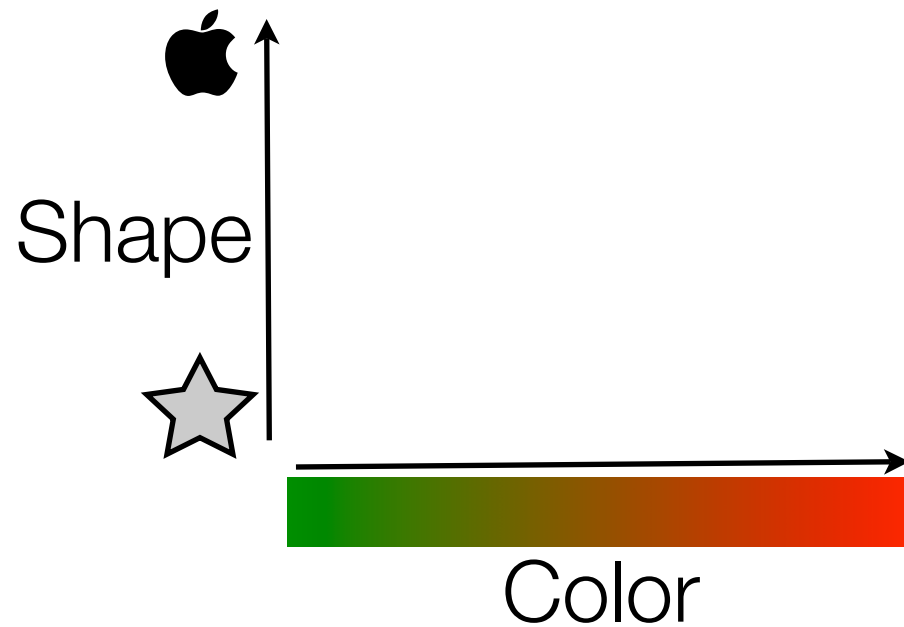
Multi-dimensional Semantic Space

- Define **edible** things



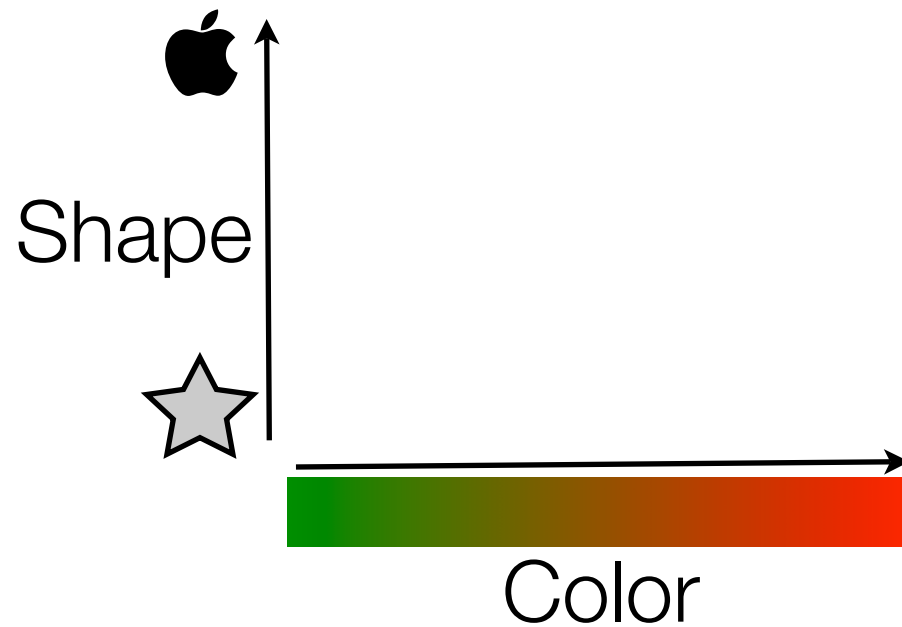
Multi-dimensional Semantic Space

- Define **edible** things
 - Rule-based approach



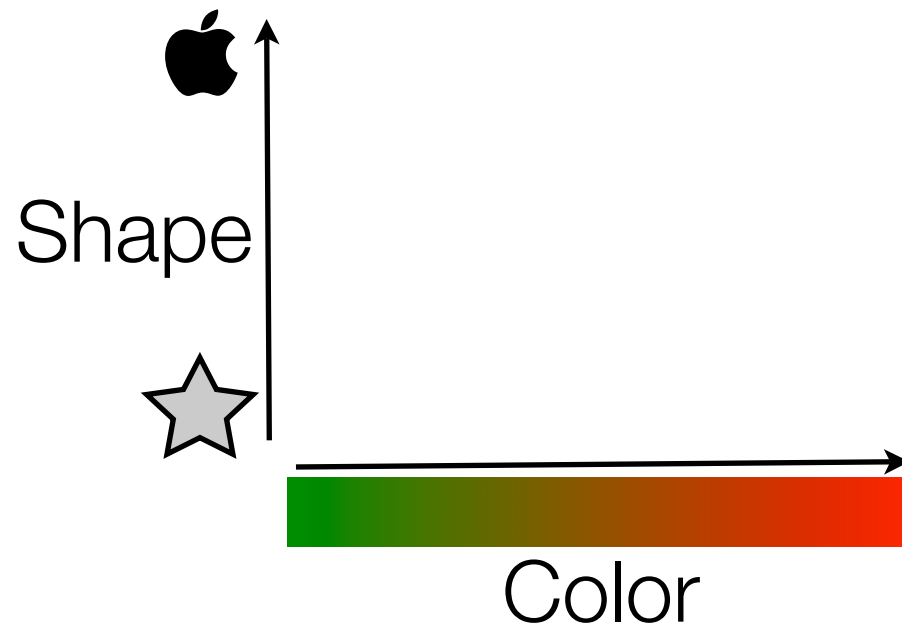
Multi-dimensional Semantic Space

- Define **edible** things
 - Rule-based approach
 - Prototype



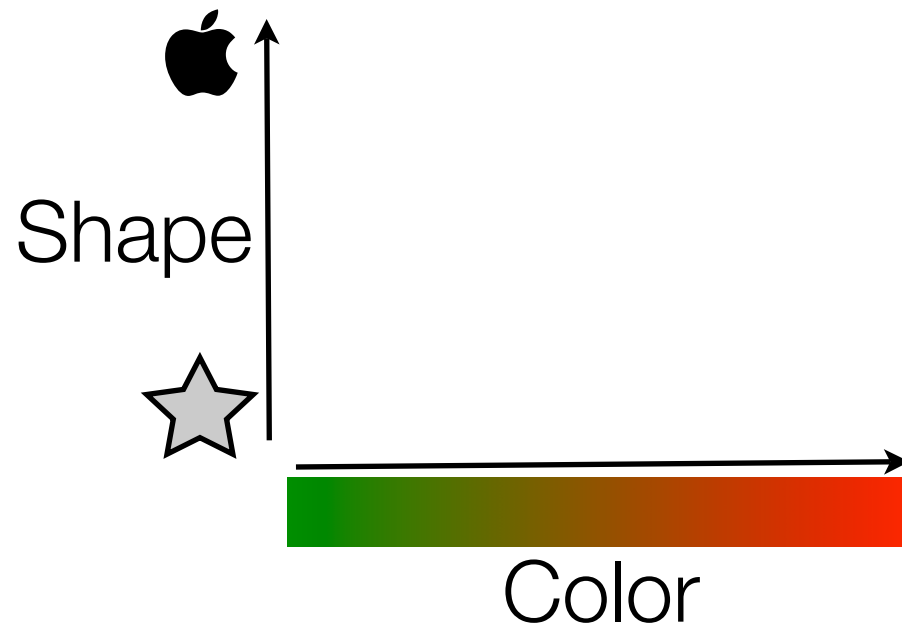
Multi-dimensional Semantic Space

- Define **edible** things
 - Rule-based approach
 - Prototype
 - Exemplars



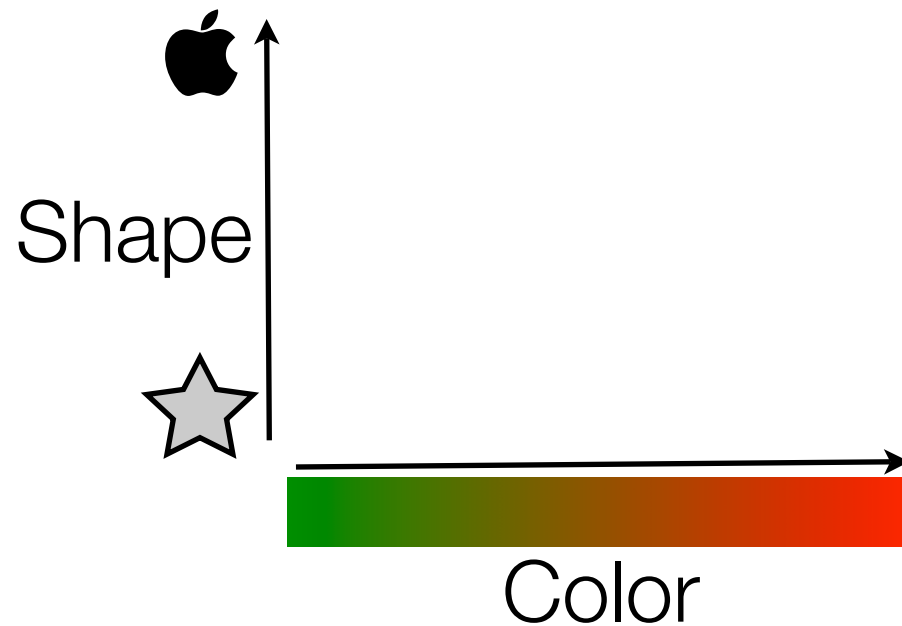
Multi-dimensional Semantic Space

- Define **edible** things
 - Rule-based approach
 - Prototype
 - Exemplars
 - Rule + Exception



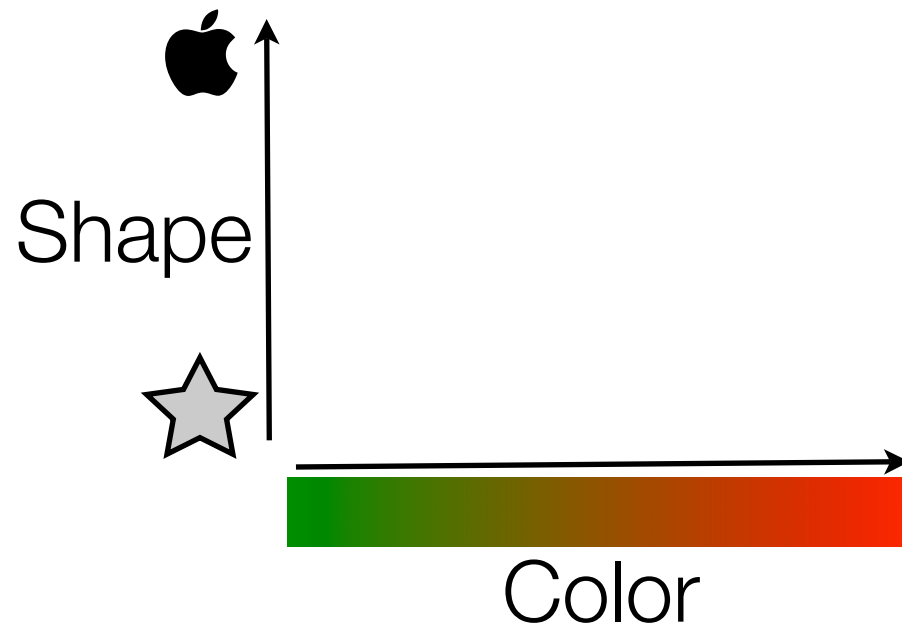
Multi-dimensional Semantic Space

- Define **edible** things
 - Rule-based approach
 - Prototype
 - Exemplars
 - Rule + Exception
 - Multi-Prototype



Multi-dimensional Semantic Space

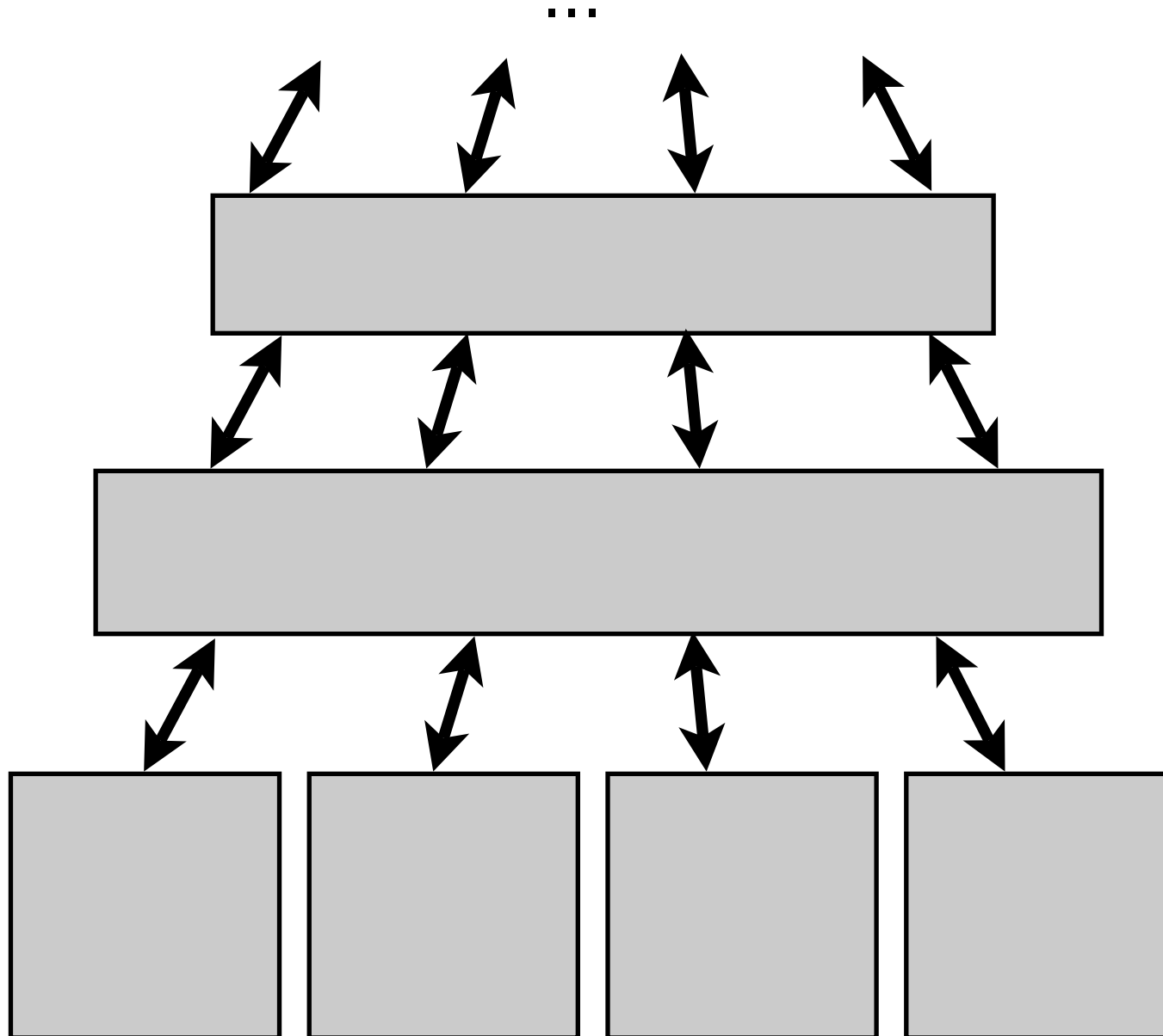
- Define **edible** things
 - Rule-based approach
 - Prototype
 - Exemplars
 - Rule + Exception
 - Multi-Prototype
 - Configural



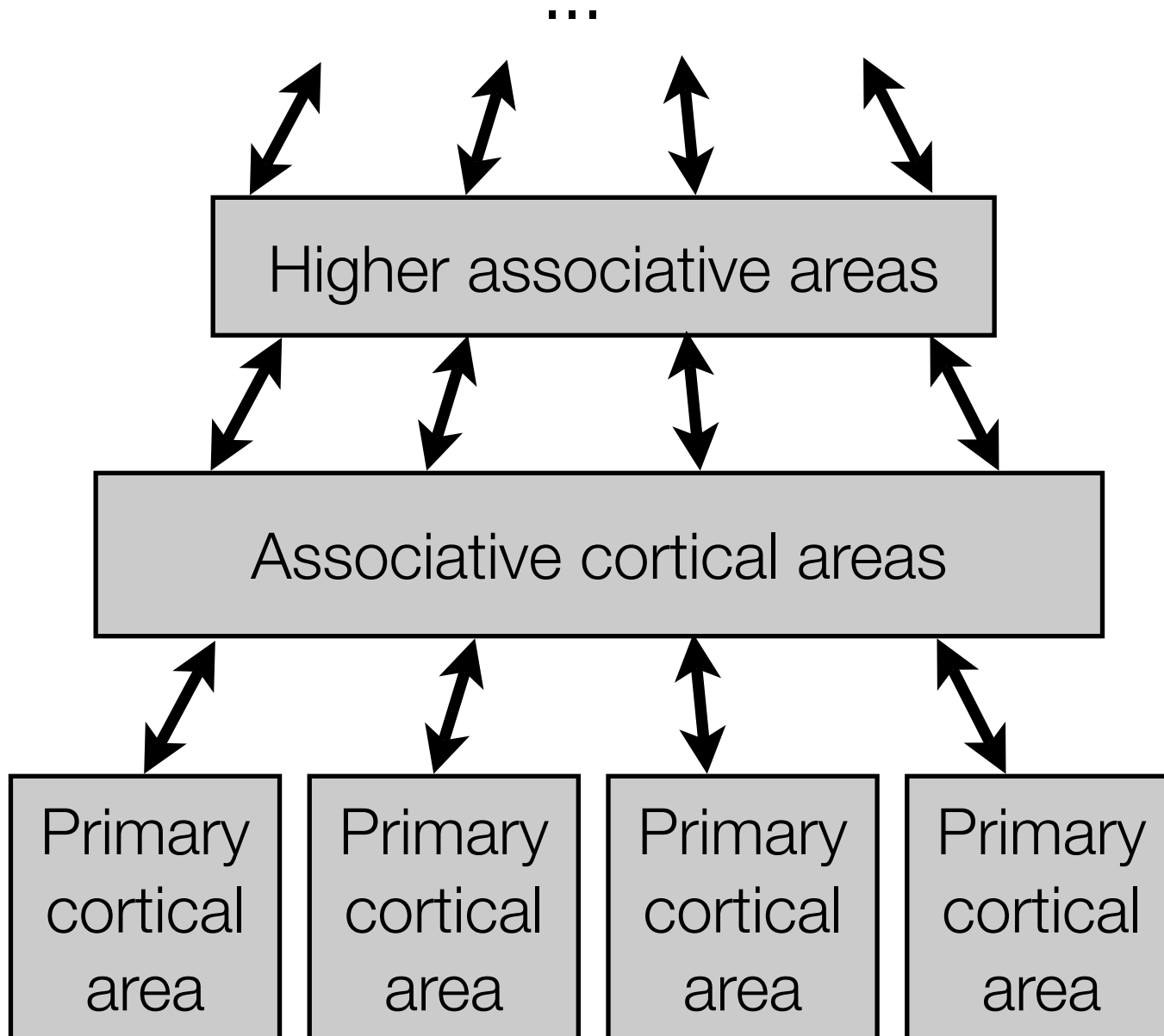
Hierarchy in categories

- Types/Tokens
- ...
 - Things that are alive
 - Bird
 - Sparrow
 - Song Sparrow
 - My song sparrow named Bob
 - My song sparrow named Bob last Tuesday at 6:34pm ...

Hierarchies in the brain



The Cortex



Hierarchical learning vs Sequential learning

- Sequence learning
 - what follows what?

- Hierarchical learning
 - sequences of sequences

Imagine you're a neuron...

Final Project

- who's your partner?
- what's your topic?

Next time...

- HW 7 due by Sunday
- Chapter 9 on Monday
- No quiz